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Role of Inflammatory Markers (CRP, ESR, Ferritin) in Predicting Severity of Infectious Diseases: A Hospital-Based Study.

Aditya Uday Kanhere[1] and Nikita Deepak Parashar[2*].
[1]Associate Professor, Department of Pathology, Saraswati Institute of Medical Sciences, Hapur, India.
[2]Assistant Professor, Department of Pathology, Krishna Mohan Medical College & Hospital, Mathura, India.

Correspondence:
Nikita Deepak Parashar
Assistant Professor, Department of Pathology, Krishna Mohan Medical College & Hospital, Mathura, India.

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Abstract
Background: Inflammatory markers such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and ferritin are widely used in clinical practice to assess inflammation and disease severity. Their role in predicting severity of infectious diseases is of increasing importance. ***Aim:*** To evaluate the role of CRP, ESR, and ferritin levels in predicting the severity of infectious diseases. ***Methods:*** A hospital-based cross-sectional study was conducted among 180 patients diagnosed with infectious diseases. Patients were categorized into mild, moderate, and severe groups based on clinical criteria. Serum CRP, ESR, and ferritin levels were measured and compared across groups. Statistical analysis was performed using SPSS, with $p < 0.05$ considered significant. ***Results:*** Mean CRP, ESR, and ferritin levels were significantly higher in severe cases compared to mild and moderate cases ($p < 0.001$). Ferritin showed the strongest correlation with disease severity ($r = 0.68$), followed by CRP ($r = 0.61$) and ESR ($r = 0.49$). ***Conclusion:*** CRP, ESR, and ferritin are valuable biomarkers for predicting severity of infectious diseases, with ferritin showing the strongest association.

Keywords: CRP, ESR, Ferritin, Infectious diseases, Inflammation, Biomarkers.

INTRODUCTION
Infectious diseases remain a major cause of morbidity and mortality worldwide. Early identification of disease severity is crucial for timely intervention and improved outcomes. Inflammatory markers play an important role in assessing the host response to infection.

C-reactive protein (CRP) is an acute-phase reactant produced by the liver in response to inflammation. It rises rapidly in bacterial infections and is widely used as a marker of disease activity. Erythrocyte sedimentation rate (ESR) is another commonly used marker, although it is less specific and influenced by various factors. Ferritin, an intracellular iron storage protein, also acts as an acute-phase reactant and has gained attention as a marker of severe inflammation and cytokine storm.

Recent studies, especially during the COVID-19 pandemic, have highlighted the importance of ferritin as a predictor of disease severity. Elevated levels of CRP and ESR have also been associated with worse clinical outcomes in various infectious conditions.

Despite widespread use, there is limited comparative data evaluating these markers together in predicting disease severity. The present study aims to assess the role of CRP, ESR, and ferritin in predicting severity of infectious diseases.

MATERIALS AND METHODS
Study Design and Setting
Hospital-based cross-sectional study conducted over 1 year in the Department of Pathology.

Study Population
Patients diagnosed with infectious diseases admitted to the hospital.

Sample Size
A total of 180 patients were included.

Inclusion Criteria
- Patients aged ≥18 years
- Laboratory-confirmed infectious disease
- Willing to participate

Exclusion Criteria
- Chronic inflammatory diseases
- Autoimmune disorders
- Malignancy

Data Collection
- Clinical severity categorized as mild, moderate, severe
- Blood samples collected for:
  - CRP (immunoturbidimetric method)
  - ESR (Westergren method)
  - Ferritin (chemiluminescence assay)

Statistical Analysis
- SPSS version 25
- ANOVA for comparison
- Pearson correlation
- $p < 0.05$ considered significant

RESULTS

A total of 180 patients with infectious diseases were included in the study. The mean age of the participants was 42 ± 15 years, indicating a wide age distribution ranging from young adults to elderly individuals. Males constituted 58% of the study population, while females accounted for 42%, showing a slight male predominance.

Based on clinical assessment, patients were categorized into three severity groups. Mild cases comprised 35% of the study population, moderate cases accounted for 40%, and severe cases constituted 25%. This distribution reflects a balanced representation across different levels of disease severity, allowing for meaningful comparison of inflammatory markers.
Analysis of inflammatory markers revealed a significant association with disease severity. Serum C-reactive protein (CRP) levels were markedly elevated in patients with severe disease compared to those with mild and moderate illness, and this difference was statistically significant ($p < 0.001$). Similarly, erythrocyte sedimentation rate (ESR) showed a progressive increase with increasing severity, demonstrating a significant trend across the three groups ($p < 0.001$). Among the markers studied, serum ferritin levels were found to be the highest in the severe group, indicating a strong association with intense inflammatory response ($p < 0.001$).

Further evaluation using correlation analysis provided additional insights into the relationship between these biomarkers and disease severity. Ferritin demonstrated the strongest positive correlation with severity ($r = 0.68$), suggesting its potential as a reliable indicator of severe infection. CRP also showed a strong positive correlation ($r = 0.61$), reinforcing its role as an important acute-phase reactant in infectious conditions. ESR exhibited a moderate positive correlation with disease severity ($r = 0.49$), indicating that although useful, it is relatively less specific compared to CRP and ferritin.

Overall, the findings indicate that all three inflammatory markers—CRP, ESR, and ferritin—are significantly associated with the severity of infectious diseases. Among them, ferritin appears to be the most sensitive marker, followed by CRP, while ESR shows a comparatively weaker but still significant association. These results highlight the potential utility of these biomarkers in clinical practice for early identification and stratification of patients based on disease severity.

DISCUSSION

The present study demonstrates that inflammatory markers such as CRP, ESR, and ferritin are significantly elevated in patients with severe infectious diseases. Among these, ferritin showed the strongest correlation with disease severity, indicating its potential role as a reliable biomarker.

CRP is a well-established marker of acute inflammation and rises rapidly in response to infection. The findings of this study are consistent with previous research showing elevated CRP levels in severe infections. ESR, although less specific, also showed a significant association with disease severity.
Ferritin has emerged as an important marker in recent years, particularly in severe infections and cytokine storm syndromes. Elevated ferritin levels reflect increased inflammatory activity and have been associated with poor outcomes.
The findings of this study support the use of these markers in clinical practice for early identification of high-risk patients. Combining these markers may improve accuracy in predicting disease severity.

CONCLUSION

CRP, ESR, and ferritin are valuable biomarkers for assessing severity of infectious diseases. Ferritin shows the strongest correlation and may serve as an important predictor of severe disease. Routine assessment of these markers can aid in early risk stratification and management.

Limitations

- Single-center study
- Cross-sectional design
- No follow-up outcomes

Recommendations

- Use of combined biomarker approach
- Larger multicentric studies
- Inclusion of additional markers like IL-6, D-dimer.

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